Fair Weather or Foul?
The Macroeconomic Effects of El Niño

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Motivation

- A rapidly growing literature investigates the relationship between **climate** (temperature, precipitation, storms, and other aspects of the weather) and **economic performance** (agricultural production, labor productivity, commodity prices, health, conflict, and economic growth).
- This is important as a careful understanding of the climate-economy relationship is essential to the effective design of appropriate institutions and macroeconomic policies, as well as enabling forecasts of how future changes in climate will affect economic activity.
- Our focus on El Niño weather events is motivated by growing concerns about their effects not only on the global climate system, but also on commodity prices and the macroeconomy of different countries.
- These extreme weather conditions can constrain the supply of rain-driven agricultural commodities, create food-price and generalized inflation, and may trigger social unrest in commodity-dependent countries that primarily rely on imported food.
- We study the effects of El Niño shocks on 21 individual countries/regions (some of which are directly affected by El Niño) in an interlinked and compact model of the world economy—with a focus on growth, inflation, energy and non-fuel commodity prices.

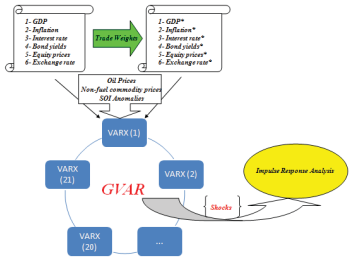
Literature

- Despite their importance, the macroeconomic effects of the most recent strong El Niño events of 1982/83 and 1997/98, along with the more frequent occurrences of weak El Niños, are under-studied.
- There are a number of papers looking at the effects of El Niño on:
  - particular **countries**, for example, Australia and the United States (Changnon 1999 and Debelle and Stevens 1995);
  - a particular **sector**, for instance, agriculture and mining (Adams et al. 1995 and Solow et al. 1998);
  - or particular **commodity markets**, including coffee, corn, and soybean (Handler and Handler 1983, Iizumi et al. 2014, and Ubilava 2012).
- Brunner (2002) argues that the ENSO cycle can explain about 10–20% of the variation in the GDP growth and inflation of G-7 economies, and about 20% of real commodity price movements over 1963–1997.

Modelling the Climate-Macroeconomy Relationship in a Global Context

- To analyze the macroeconomic transmission of El Niño shocks, both nationally and internationally, we employ a dynamic multi-country framework (covering over 90 percent of world GDP).
- This framework takes into account both the temporal and cross-sectional dimensions of the data; real and financial drivers of economic activity; interlinkages and spillovers that exist between different regions; and the effects of unobserved or observed common factors (e.g. energy and non-fuel commodity prices).
- This is crucial as the impact of El Niño shocks cannot be reduced to one country but rather involve multiple regions, and may be amplified or dampened depending on the degree of openness of the countries and their trade structure.

The Global VAR (GVAR) Methodology



Country Coverage

Asia and Pacific	North America	Europe
Australia	Canada	Austria
China	Mexico	Belgium
India	United States	Finland
Indonesia		France
Japan	**South America**	Germany
Korea	Argentina	Italy
Malaysia	Brazil	Netherlands
New Zealand	Chile	Norway
Philippines	Peru	Spain
Singapore		Sweden
Thailand	**Middle East and Africa**	Switzerland
	Saudi Arabia	Turkey
	South Africa	United Kingdom

The Effects of El Niño on Real Output Growth

- Contrary to the findings of earlier studies, the results of our dynamic multi-country model of the world economy indicate that the economic consequences of El Niño shocks are large, statistically significant, and highly heterogeneous across different regions.
- Australia, Chile, Indonesia, India, Japan, New Zealand and South Africa face a short-lived fall in economic activity in response to an El Niño shock.
- For other countries, an El Niño event has a growth-enhancing effect; some (for instance the United States) due to direct effects while others (for instance the European region) through positive spillovers from major trading partners.

The Effects of El Niño on Real Output Growth II

Country	Impact	Cumulated Responses After			
		1 Quarter	2 Quarters	3 Quarters	4 Quarters
Argentina	-0.08	0.03	0.29*	0.64**	1.08**
Australia	-0.03	-0.18**	-0.30**	-0.37*	-0.41
Brazil	-0.06	0.04	0.20	0.42*	0.68*
Canada	0.00	0.13**	0.33*	0.58**	0.85**
China	-0.01	0.03	0.16*	0.36*	0.56*
Chile	-0.19*	-0.10	0.16*	0.42*	0.70*
Europe	0.02	0.09	0.27**	0.49**	0.69**
India	-0.03	-0.15*	-0.23	-0.25	-0.25
Indonesia	-0.35**	-0.61*	-0.91*	-1.02	-1.01
Japan	-0.10*	-0.12	0.01*	0.20*	0.37*
Korea	0.11	0.29*	0.44	0.58	0.67
Malaysia	0.08	0.06	0.13	0.27	0.43
Mexico	0.03	0.37**	0.71*	1.12*	1.57**
New Zealand	-0.16**	-0.29*	-0.37	-0.42	-0.43
Peru	-0.07	-0.28	-0.35	-0.34	-0.33
Philippines	0.06	0.09	0.11	0.17	0.21
South Africa	-0.11**	-0.24*	-0.47**	-0.63*	-0.72
Saudi Arabia	-0.09	-0.17	-0.14	0.00	0.18
Singapore	0.09	0.28*	0.54*	0.87*	1.18*
Thailand	0.47**	0.78**	1.11**	1.49**	1.81**
USA	0.05*	0.10	0.23*	0.39*	0.55*

Share of Primary Sector in GDP (in percent)

Averages over 2004-2013

Asia and Pacific		North America	
Australia	11	Canada	10
China	11	Mexico	12
India	21	United States	3
Indonesia	25		
Japan	1	**South America**	
Korea	3	Argentina	11
Malaysia	22	Brazil	7
New Zealand	6	Chile	18
Philippines	14	Peru	20
Singapore	0		
Thailand	15	**Africa**	
		South Africa	10

Overall, the larger the geographical area of a country, the smaller the primary sector's share in national GDP, and the more diversified the economy is, the smaller is the impact of El Niño shocks on GDP growth.

The Effects of El Niño on Real Commodity Prices

- The higher temperatures and droughts following an El Niño event, particularly in Asia-Pacific countries, not only increases the prices of non-fuel commodities, but also leads to higher demand for coal and crude oil as lower electricity output is generated from both thermal power plants and hydroelectric dams.
- In addition, farmers increase their water demand for irrigation purposes, which further increases the fuel demand for power generation and drives up energy prices.

Series	Impact	Cumulated Responses After			
		1 Quarter	2 Quarters	3 Quarters	4 Quarters
Non-Fuel Commodity Prices	0.42	0.77	1.97**	3.75**	5.31**
Oil Prices	1.20*	4.23*	7.80**	11.09**	13.87**

The Effects of El Niño on Real Commodity Prices II

- Although the initial increase in oil prices (as a proxy for fuel prices) arises from higher demand for power, oil prices remain high even four quarters after the initial shock.
- This is because an El Niño event has positive growth effects on major economies which demand more oil to be able to sustain higher production.
- Therefore, what was initially an increase in oil prices due to higher demand from Asia translates into a global oil demand shock a couple of quarters later.
- Excess demand also arises for non-fuel commodity prices (food, beverages, metals, and agricultural raw materials) mainly due to lower supply from the Asia-Pacific region, but also due to higher global demand for non-fuel commodities.

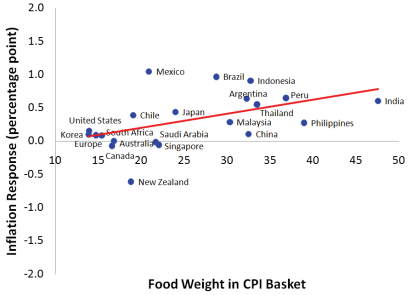
The Effects of El Niño on Inflation

- Most countries in our sample experience short-run inflationary pressures following an El Niño shock (depending mainly on the share of food in their CPI baskets).
- This is mainly due to higher fuel as well as non-fuel commodity prices, but is also the result of inflation expectations, as well as aggregate demand-side pressures for those countries which experience a growth pick-up following an El Niño episode.

The Effects of El Niño on Inflation II

Country	Impact	Cumulated Responses After			
		1 Quarter	2 Quarters	3 Quarters	4 Quarters
Argentina	0.51	0.79	0.57	0.92	0.64
Australia	-0.01	0.02	0.02	0.01	0.00
Brazil	-0.30	-0.21	1.01	1.49	0.97
Canada	-0.05*	-0.10	-0.08	-0.07	-0.07
China	0.00	-0.02	0.00	0.06*	0.11*
Chile	0.14**	0.14	0.29**	0.32	0.39*
Europe	0.00	0.00	0.02	0.06*	0.09*
India	0.15*	0.16	0.42**	0.56**	0.60
Indonesia	0.25*	0.61**	0.87*	0.95	0.91
Japan	0.03*	0.05	0.04	0.06	0.10**
Korea	0.01	0.12**	0.22**	0.34**	0.44**
Malaysia	0.05*	0.09	0.16*	0.23*	0.28*
Mexico	0.22	0.60*	1.01*	1.12	1.04
New Zealand	-0.06	-0.23**	-0.39**	-0.55**	-0.61*
Peru	-0.06	-0.73	-0.48	-0.38	0.65
Philippines	0.11	0.06	0.19*	0.22	0.27
South Africa	0.10**	-0.01**	0.02	0.06	0.09
Saudi Arabia	0.01	-0.03*	-0.02	-0.01	-0.02
Singapore	-0.07**	-0.06	-0.06	-0.06	-0.06
Thailand	0.01	0.21**	0.35**	0.46**	0.55**
USA	0.01	0.02	0.10*	0.14*	0.15

Food Weight in CPI Basket and Inflation Responses



Summary of Results

- To analyze the international macroeconomic transmission of El Niño shocks we estimated a GVAR model for 21 countries/regions over the period 1979Q2–2013Q1.
- Our modelling framework took into account real and financial drivers of economic activity; interlinkages and spillovers that exist between different regions; and the effects of unobserved or observed common factors (e.g. energy and non-fuel commodity prices).
- We showed that there are considerable heterogeneities in the responses of different countries to El Niño shocks. While Australia, Chile, Indonesia, India, Japan, New Zealand and South Africa face a short-lived fall in economic activity following an El Niño weather shock, the United States, Europe and China actually benefit (possibly indirectly through third-market effects) from such a climatological change.
- Most countries in our sample experience short-run inflationary pressures following an El Niño shock (depending mainly on the share of food in their CPI baskets), while global energy and non-fuel commodity prices increase.

Policy Implications

- The sensitivity of growth and inflation in different countries, as well as global commodity prices, to El Niño developments raises the question of which policies and institutions are needed to counter the adverse effects of such shocks.
- Measures to bolster agricultural production in low-rainfall El Niño years include changes in the cropping pattern and input use (e.g. seeds of quicker-maturing crop varieties), rainwater conservation, judicious release of food grain stocks, and changes in imports policies/quantities.
- On the macroeconomic policy side, any uptick in inflation arising from El Niño shocks could be accompanied by a tightening of the monetary stance (if second-round effects emerge), to help anchor inflation expectations.
- Investment in agriculture sector, mainly in irrigation, as well as building more efficient food value chains should also be considered in the longer-term.